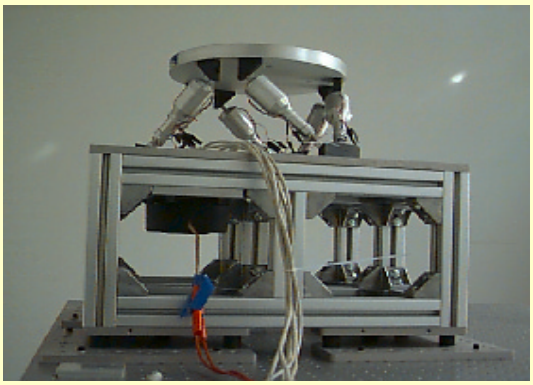
Spacecraft Research & Design Center

Department of Aeronautics and Astronautics

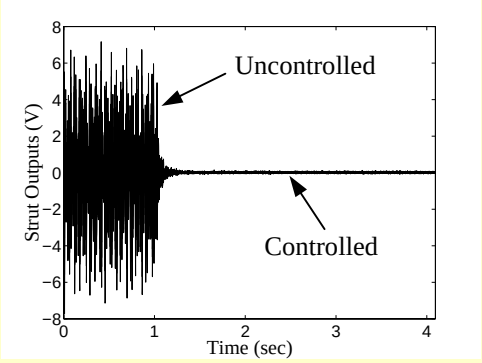
Naval Postgraduate School

Ultra Quiet Platform



Objective: To develop and test control algorithms for vibration isolation of an imaging payload

- It is a 6 d.o.f. cubic Stewart Platform.
- Each strut consists of a piezoceramic stack actuator (PZT) and a geophone sensor.
- The maximum displacement of each actuator is 50 *mm.*
- The source of the disturbance is an Aura Bass shaker.
- The control function is performed by a dSPACE DSP system.



Several algorithms, such as the Multiple Error LMS, the Clear Box, Sine/Cosine, and the Clear Box Adaptive Basis algorithms, were developed and tested to effectively cancel narrowband disturbances. In the figure, as much as 42.3 dB overall reduction of multiple frequency disturbance in the active struts was achieved by Frequency Domain Clear Box Algorithm with Phase Cancellation Repetitive Control Updates.

Theses

1. H. J. Chen, *Multiple Periodic Disturbance Rejection Techniques for Vibration Isolation*, Ph.D. Dissertation, Columbia University, Mar.2001.
2. S. G. Edwards, *Active Narrowband Disturbance Rejection on an Ultra Quiet Platform*, Ph.D. Dissertation, Naval Postgraduate School, Sep. 1999.
3. G. D. Beaver, *System Identification of an Ultra Quiet Vibration Isolation Platform*, MS Thesis, Naval Postgraduate School, Jun. 1997.

Publications

1. H. J. Chen, R. W. Longman, B. N. Agrawal, M. Q. Phan, and S. G. Edwards, "Rejection of Multiple Periodic Disturbances Using MELMS with Disturbance Identification," *Proceedings of the 11th AAS/AIAA Space Flight Mechanics Meeting*, Feb. 2001.
2. B. N. Agrawal and H. J. Chen, "Active Vibration Isolation on Spacecraft Using Smart Struts," *Proceedings of the 51st IAF International Astronautical Congress*, Oct. 2000.
3. H. J. Chen, R. W. Longman, B. N. Agrawal, and M. Q. Phan, "Frequency Domain Clear Box Disturbance Rejection on an Ultra Quiet Platform," *Proceedings of the 10th AAS/AIAA Space Flight Mechanics Meeting*, Jan. 2000.
4. S. G. Edwards, B. N. Agrawal, M. Q. Phan, and R. W. Longman, "Disturbance Identification and Rejection Experiments on an Ultra Quiet Platform," *Advances in the Astronautical Sciences*, Vol. 103, 1999, pp. 633-651.

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